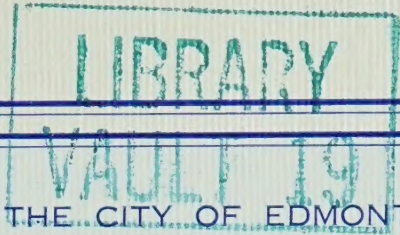




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IN THE MATTER OF AN APPLICATION OF THE CITY OF EDMONTON
FOR APPROVAL OF THE CONSTRUCTION AND OPERATION
OF AN ADDITION TO THE CLOVER BAR POWER PLANT,
AND FOR AN ORDER FOR ITS INTERCONNECTION



1972



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REPORT TO
THE LIEUTENANT GOVERNOR IN COUNCIL



IN THE MATTER OF AN APPLICATION OF THE CITY OF EDMONTON
FOR APPROVAL OF THE CONSTRUCTION AND OPERATION
OF AN ADDITION TO THE CLOVER BAR POWER PLANT,
AND FOR AN ORDER FOR ITS INTERCONNECTION

1972

ENERGY RESOURCES CONSERVATION BOARD

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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
I	INTRODUCTION.....	1
	Application and Hearing	1
	Appearances	1
	The Background to the Application and the Application	2
	The Board's Concern and Responsibilities	3
II	SPECIFIC ISSUES OF THE APPLICATION.....	6
III	THE NEED FOR AND THE SUITABILITY OF THE INCREASED CAPACITY.....	9
IV	THE SUITABILITY OF THE CHOICE OF THE ENERGY RESOURCES AND THE ADEQUACY OF THE FUEL RESERVES.....	25
V	THE SUITABILITY OF PROVIDING THE INCREASED CAPACITY AT THE CLOVER BAR SITE.....	28
VI	THE ENERGY CONVERSION EFFICIENCY.....	31
VII	THE RELATIONSHIP OF THE PROPOSED ADDITION TO THE EXISTING POWER PLANT.....	34
VIII	THE IMPACT OF THE PROPOSAL ON THE ENVIRONMENT	36
	Atmosphere	36
	Water	40
IX	THE ADEQUACY OF THE PRESENT PLANNING FOR THE EXPANSION OF ELECTRIC GENERATION AND TRANSMISSION FACILITIES IN ALBERTA.....	45
X	DECISION.....	50
	APPENDIX A.....	A-1
	Subsisting Approvals for the Clover Bar Power Plant	

APPENDIX B.....	B-1
Forms of Approval and Order	

LIST OF TABLES AND FIGURES

Table

III-1	Schedule of Proposed New Generating Capacity	11
III-2	Forecast of the Number of Large Generating Units on the Interconnected System.....	19

FIGURE

III-1	Alberta Interconnected System Annual Demand and Generating Capability.....	21
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I INTRODUCTION

Application and Hearing

The City of Edmonton applied under section 7 of The Hydro and Electric Energy Act for approval of the addition of two 165 megawatt electric generating units to its Clover Bar power plant on the east bank of the North Saskatchewan River and in the north-east section of the City, and for an order directing connection of the additional units to its electric distribution system and to transmission lines of Calgary Power Ltd.

The application was heard in Edmonton on January 13, 1972, by the Energy Resources Conservation Board with G. W. Govier, P. Eng., V. Millard, J. I. Strong, P. Eng. and N. Berkowitz sitting.

Appearances

The following appeared at the hearing:

	Abbreviation of Name Used in Report	Represented by	Witnesses
City of Edmonton	Edmonton Power	A.F. Macdonald, Q.C.	F. Battistella, P.Eng. V. Kondrosky, P.Eng. J. Lukacs, P.Eng.
City of Calgary	City of Calgary	W.E. Hawkins, P.Eng. A.A. Bishop, P.Eng.	
Canadian Utilities, Limited	Alberta Power	W.G. Sterling, P.Eng.	

A corporate reorganization completed since the hearing has resulted in the electric energy facilities which were formerly operated by Canadian Utilities, Limited now being operated by

Alberta Power Limited. In this report it is convenient to refer to these closely related corporations as Alberta Power.

The City of Calgary in its intervention was concerned not so much with the power plant additions proposed, but with the planning and development of future electric energy generating projects in Alberta.

Alberta Power intervened to advise the Board that upon review of the application it considered the proposed additions to conform with the Reserve Sharing Agreement and to be in the public interest.

The Background to the Application and the Application

The City of Edmonton is a local authority within the meaning of The Hydro and Electric Energy Act.

The applicant has the second largest electric generating system in the Province. Its proportion of the interconnected system energy requirement in 1970 was 21 per cent, compared to 59.8 per cent for Calgary Power Ltd, and 14.7 per cent for Alberta Power. Its power plants and electric distribution system are connected to the transmission lines of Calgary Power Ltd. and through the latter system indirectly to that of Alberta Power. Alberta Power, Calgary Power and Edmonton Power have a Reserve Sharing Agreement, the principal points of which were set forth in Appendix C of ERCB Report 71-C-HE.⁽¹⁾ The approvals and authorizations under which Edmonton Power has constructed and

(1) In the Matter of an Application of Canadian Utilities, Limited for Approval of the Construction and Operation of an Addition to the Battle River Power Plant, and for an Order for its Interconnection. October 1971.

operated its Clover Bar power plant are listed in Appendix A to this report.

For many years Edmonton Power has operated a power plant at Rosssdale in Edmonton to supply the City's requirements. In September 1970, the first 165 MW unit at the new Clover Bar site was commissioned and a second unit of the same size is scheduled for commissioning in 1973.

The capacity of the power plant after the addition of two units proposed in the subject application would be 660 megawatts. The power plant would be fuelled with gas obtained from Northwestern Utilities, Limited. The waste gases produced in connection with the proposed two units would be exhausted to the atmosphere through a single 231-foot high stack and would contain no particulate matter or sulphur dioxide, but would contain twelve long tons per day of nitrous oxides when both units were operated at maximum continuous rating. Cooling water would be drawn from the North Saskatchewan River and returned to it after use. Maximum cooling water flow would be 700 cubic feet per second when the plant is generating 660 megawatts. Water containing chemicals discharged from the power plant would be conveyed to a disposal pit for neutralization and testing before being returned to the river.

The Board's Concern and Responsibilities

The Board had occasion to consider applications for major additions to thermal power plants as reported in ERCB Report

71-C-HE and ERCB Report 72-C-HE. (2) In those reports, The Hydro and Electric Energy Act, and particularly sections 2, 7 and 35, as it affected such applications was discussed at length. Also discussed was the concurrent jurisdiction of the Department of the Environment with respect to those aspects entailing the control of pollution and the ensurance of environment conservation.

For the reasons set out in the above mentioned reports, the Board's consideration of the present application will not involve all aspects of Provincial reserves, productive capacity and requirements of electric energy. But is concerned with the part the additional facilities will play in the economic, orderly and efficient generation of electric energy in Alberta. As pointed out by the applicant, the Board had included the fuel requirements of the Clover Bar power plant in estimating the Alberta requirements for gas for the period from January 1, 1970 to December 31, 1999. (3)

The Board notes the size of the proposed power plant expansion, the fact that it could be considered a nearly independent power plant in itself, the environmental matters involved, and the fact that the applications for the first two units at Clover Bar were not considered by this Board. In these circumstances

(2) In the Matter of an Application of Calgary Power Ltd. for Approval of the Construction and Operation of Additions to the Sundance Power Plant, and for an Order for their Interconnection. September 1972.

(3) See OGCB Report 71-B. Report and Decision regarding Alberta's Future Requirements for Gas. February 1971.

and in light of the statutory provisions discussed in the above mentioned reports, the Board will deal with the application under section 7, subsection (1) of the Act, by the provisions of which the issue of an approval would require the authorization of the Lieutenant Governor in Council.

II SPECIFIC ISSUES OF THE APPLICATION

The matters of principal concern with respect to the application are essentially the same as those which were identified in connection with the application of Calgary Power Ltd. for expansion of its Sundance plant and which were discussed in Section II of ERCB Report 72-C-HE. They are repeated here in similar language for the sake of convenience.

- (1) The need for and the suitability of the proposed increased capacity.

Is the additional capacity required at the time proposed to serve the consumers supplied by Edmonton Power? Are the proposed units of suitable size to serve the needs of the Edmonton Power system? Will the proposed units, when added to the existing generating units of Edmonton Power, also suit the requirements of the Provincial interconnected system and serve the interests of the citizens of Alberta? Will the additional capacity as requested "provide for economic, orderly and efficient generation of electrical energy in Alberta"?

- (2) The suitability of the choice of the energy resource and the adequacy of the fuel reserves.

Is the proposed energy resource (i.e. gas) the most suitable and economic? If so, is the source of gas and its reserve adequate for a plant installation of the proposed capacity?

- (3) The suitability of providing the increased capacity at the Clover Bar site.

Is the Clover Bar site a suitable location to provide additional capacity to serve the consumers supplied by Edmonton

Power? Will the added generation at this site adequately serve the Provincial interconnected system whereby the citizens of the Province as a whole will also benefit?

(4) The energy conversion efficiency.

Are the proposed units efficient from the viewpoint of energy resource utilization? Does each unit incorporate all economically justifiable modern refinements in the interests of efficiency, economy and safety?

(5) The relationship of the proposed addition to the existing power plant.

Should the application for the addition to the power plant be considered separately from the existing plant or should the entire operation be reviewed as a single application? Should an approval be considered for the proposed addition only or for the total Clover Bar development?

(6) The impact of the proposal on the environment.

What is the impact of the present plan on the environment? What will be the added effect of the two additional units? What will be the combined effect of the total Clover Bar development on the atmosphere, the river, and the adjoining recreational residential and industrial developments. Does the applicant plan to install adequate protective measures? If not, what additional requirements must be provided to safeguard the total environment?

(7) The adequacy of present planning for the expansion of electric generation and transmission facilities in Alberta.

Is the present type of planning carried out by Edmonton Power, Calgary Power Ltd., and Alberta Power Ltd. as the three

principal electric energy generating utilities in the Province adequate? Should other electric utility operators be included in the planning group? Does the present system of planning furnish the Board with sufficient information so that it may ensure economic, orderly and efficient development in the public interest of hydro energy and generation of electric energy in the Province? How may the present planning be improved in order to satisfy the foregoing requirements?

III THE NEED FOR AND THE SUITABILITY OF THE INCREASED CAPACITY

Views of the Applicant

(1) Load Growth

The applicant stated it expected the relatively high rate of load growth in the City of Edmonton to continue, and predicted an annual growth in energy requirements of about ten per cent per year to the end of the Seventies. Edmonton Power also forecast the City's annual load factor to increase from about 53 per cent in 1970 to 59 per cent in 1980, and therefore projected the corresponding peak loads to increase at the rate of 9 per cent in recognition of the increasing load factor. The Edmonton peak load was projected as 711 MW in 1976 and the minimum load corresponding with that peak load would likely be about 225 MW. These latter loads correspond to 23 per cent and 7 per cent, respectively, of the interconnected system peak load projected for 1976. Edmonton Power operates an all-thermal generating system of two plants, Rosssdale and Clover Bar, connected with the Alberta interconnected system by an interconnection of 80 MW capability at the Rosssdale plant. The newer Clover Bar plant will carry base-load at a capacity factor of 65 to 70 per cent and the older Rosssdale plant will carry the cyclic peak load at a capacity factor of 20 to 40 per cent. Both thermal plants are capable of operating at higher capacity factors, and the applicant did not discuss the projected energy requirements in detail because energy deficiencies are not anticipated on the Edmonton Power system.

(2) Reserve Requirement

The applicant submitted data on load and reserve which is summarized in Table III-1. In Table III-1, the Clover Bar units are shown at 65 per cent annual capacity factor throughout and this is based on the applicant's statement that Clover Bar will operate at 65 to 70 per cent and Rosedale at 20 to 40 per cent capacity factor until 1980. Edmonton Power referred to the 15 per cent reserve capacity used as a desired minimum reserve in the Reserve Sharing Agreement, and also commented on certain criteria contained in an excerpt from the National Power Survey conducted in the United States by the Federal Power Commission.

Edmonton Power noted that the FPC survey report, which examined reserve requirements by the commonly used method of reliability calculations, stated that a new unit will affect the calculations of reserve requirement roughly in proportion to the square of the size of the unit. The applicant quoted the FPC conclusion that a disproportionate effect on reserve requirements is most noticeable when a very large unit is added to a system of small size units; and concluded that "large", in the sense used in the survey, could be considered as a 500 MW or even a 300 MW size in relation to the Edmonton Power system. The applicant further stated that the reserve margin required for a large unit should be equal to the net capability of that unit plus a 5 or 10 per cent allowance for deviations of the actual load from the expected load. Spinning reserve as such was not discussed, but the applicant did state that the Edmonton

TABLE 111-1

SCHEDULE OF PROPOSED NEW GENERATING CAPACITY

YEAR	PLANT	ANNUAL LOAD			GENERATION (AT YEAR-END)		
		LOAD FACTOR %	ENERGY REQUIREMENT GWH	NET PEAK MW	INSTALLED CAPACITY MW	CAPACITY FACTOR * %	RESERVE CAPACITY %
1971	ROSSDALE		1168		390	34.0	
	CLOVER BAR		973		171	65.0	
	COMBINED	53.6	2141	456	561	43.6	23.0
1972	ROSSDALE		1390		390	40.6	
	CLOVER BAR		973		171	65.0	
	COMBINED	54.3	2363	496	561	48.0	12.7
1973	ROSSDALE		1392		390	40.6	
	CLOVER BAR		1217		342	65.0	
	COMBINED	54.6	2609	545	732	49.3	34.3
1974	ROSSDALE		933		390	27.3	
	CLOVER BAR		1947		342	65.0	
	COMBINED	55.2	2880	595	732	44.9	23.0
1975	ROSSDALE		1233		390	36.0	
	CLOVER BAR		1947		342	65.0	
	COMBINED	55.7	3180	651	732	49.5	12.4
1976	ROSSDALE		1328		390	38.8	
	CLOVER BAR		2190		513	65.0	
	COMBINED	56.3	3510	711	903	51.7	27.0
1977	ROSSDALE		954		390	27.9	
	CLOVER BAR		2921		513	65.0	
	COMBINED	56.9	3875	777	903	48.9	16.2
1978	ROSSDALE		1111		390	32.5	
	CLOVER BAR		3164		684	65.0	
	COMBINED	57.5	4275	849	1074	51.6	26.5
1979	ROSSDALE		828		390	24.1	
	CLOVER BAR		3894		684	65.0	
	COMBINED	58.6	4722	928	1074	50.2	15.7
1980	ROSSDALE		1319		390	38.6	
	CLOVER BAR		3894		684	65.0	
	COMBINED	58.6	5213	1015	1074	55.4	5.8

* CLOVER BAR UNITS ASSUMED TO OPERATE AT 65% ANNUAL CAPACITY FACTOR, WITH NEW UNITS PRORATED TO 3 MONTHS OUT OF TWELVE IN THE YEAR SCHEDULED COMMERCIAL OPERATION BEGINS

NOTE THE APPLICATION IS FOR UNITS WITH A NOMINAL NAMEPLATE RATING OF 165 MEGAWATTS HOWEVER, FOLLOWING TESTS ON THE EXISTING CLOVER BAR UNITS, THE APPLICANT REFERS TO THE MAXIMUM ATTAINABLE CONTINUOUS RATING OF 171 MEGAWATTS.

Power contribution to the interconnected system's underfrequency load-shedding program was 120 MVA in early 1972.

(3) The Size and Scheduling of the Units Proposed

Edmonton Power stated that the Clover Bar site has been planned as a four-unit plant with matched pairs of 171 MW units. The scheduling of these units and the associated reserve capacity is shown on Table III-1. By planning and constructing the number 3 and number 4 machines as a pair of units in sequence, the applicant said it expected to save about \$1,300,000 as compared with the cost of installing a pair of individually designed units. The 171 MW unit size proposed for installation in 1976 was forecast to be equivalent to 23 per cent of the Edmonton annual peak load and 5 per cent of the corresponding peak load on the interconnected system, and Edmonton Power stated that 5 to 10 per cent of interconnected system peak load was normally the maximum size for a new unit. Also, in this particular case, a unit larger than 171 MW would be inefficient if operated solely for the Edmonton system at times of light load. It further argued that efficiency and cost advantages of a 300 MW unit did not justify the increased size, and should the load growth drop to "the national average" of 7 per cent, a 171 MW unit would be much more suitable for their system. Finally, the applicant stated that a total plant capability of about 660 MW at the Clover Bar site was determined on the basis of available cooling water from the river and an anticipated shift of the City's future growth in energy requirements to the south-west corner of Edmonton.

Views of the Interveners

(1) The City of Calgary

The City of Calgary interpreted Edmonton Power's statements about studies of possible coal-firing and economical power as a willingness to consider a joint venture. The City of Calgary also stated that there was an obvious advantage in the consolidation of reserve into a few relatively large units on a combined system, and that the size of unit proposed by Edmonton Power was related primarily to that applicant's system. This intervener suggested that the Board require that all new applications for power plants in the future include a section entitled "Economic Features of Installation". It noted that the figures presented by the applicant under this section implied that the City of Calgary might realize a saving in energy costs by entering into a joint venture and becoming a co-owner of a generating plant.

The City of Calgary concluded by stating that it did not oppose either the subject application or the Calgary Power application then also before the Board, but that the Board should favor the formation of "joint-venture" generating projects sized to the overall requirements of the whole Provincial system.

(2) Calgary Power

Calgary Power did not intervene but did state it was an interested party.

(3) Alberta Power

Alberta Power stated that the proposed additions at the Clover Bar plant were in accordance with the provisions of the

Reserve Sharing Agreement and were compatible with the plans of Alberta Power and Calgary Power. Alberta Power did not comment on the specific size of unit chosen.

Views of the Board

(1) Load Growth

The proposed addition of capacity at the Clover Bar site will have a significant effect on the interconnected system and is thereby closely related to the proposed addition of capacity at the Sundance site. For completeness and continuity, parts of the discussion with respect to the Sundance site have been repeated in what follows in connection with Clover Bar.

The Board has considered the forecast of load growth rate of approximately 10 per cent until 1980, presented by Edmonton Power and Calgary Power, and also similar forecasts presented earlier in connection with the Battle River Power plant extension. After a hearing in 1970 on Provincial requirements for gas, the Board adopted a Provincial long term average annual electric energy load growth forecast of 8 per cent extending into the Eighties. The National Energy Board has, from time to time, published forecasts showing an annual load growth of 7 per cent for Canada and 8 per cent for Alberta for periods extending into the Eighties. During the 20 years to and including 1971, the average annual growth of electric energy requirements in Alberta has been more than 10 per cent and at the present time there are no indications that there will be a drastic reduction in the growth of energy requirements before 1980. It is generally

accepted as prudent short term planning to use the most recent trend.

The Board accepts the load forecasts of both Edmonton Power and Calgary Power as being realistic for present planning of the electric system of the Province into the late Seventies. The forecasts by Edmonton Power and Calgary Power, of a gradual increase of annual load factor to perhaps 5 per cent higher than experienced in 1971 is accepted as a reasonable estimate in the light of present economic conditions.

(2) Reserve Requirement, Size and the Scheduling
of the Units Proposed

Edmonton Power and Calgary Power each presented a qualitative discussion of the reserve margins required by their individual systems and by the interconnected Provincial system. Neither appeared to have made a detailed quantitative study of the reserve requirements. Edmonton Power referred to conclusions resulting from such studies performed elsewhere on the continent. Such conclusions would be more relevant if they had resulted from calculations based on the Alberta system.

The Board understands that many operators of large electric utilities and power pools perform quantitative reliability calculations based on recognized principles of statistical analysis and probability methods. Some of the literature available on the subject of reserve margin suggests that systems with a firm peak demand of 2000 MW or more, or with 10 or more major generating units find such calculations essential for their generation planning. The electric industry in Alberta has

understandably not considered such calculations necessary in the past, but with a 1971 firm peak demand of about 2000 MW, and a number of different sizes of generating units as shown in Table III-2, a more precise method of evaluating and stating reserve requirements would now seem appropriate for future planning of the interconnected system. The Board recognizes that informed judgment is important when establishing reserve margins and that errors in forecasting and unforeseen changes in the economy tend to limit the confidence in the forecast on which reserve margins are based, but it believes the time has arrived when such judgment should have the support of specifically applicable quantitative analysis.

The generating schedule proposed by Edmonton Power, Calgary Power and Alberta Power for the Alberta interconnected system is presented in Figure III-1. From Figure III-1, the Board notes that after 1975 the capacity reserve would vary from a high of about 28 per cent in 1976 to a low of about 21 per cent in 1978. Consideration of these reserve margins as surplus capacity year by year to 1980 indicates that a 500 MW unit plus a 286 MW unit could be out of service and covered by the capacity reserve. The overall capacity factor for all the thermal plants is expected to range between 55 and 60 per cent in the late-Seventies, and would increase to about 70 per cent in 1975 if the largest unit then on the system, (286 MW), were out of service for the entire year. Assuming an even more drastic outage with both a Clover Bar 171 MW unit and a Sundance 352 MW

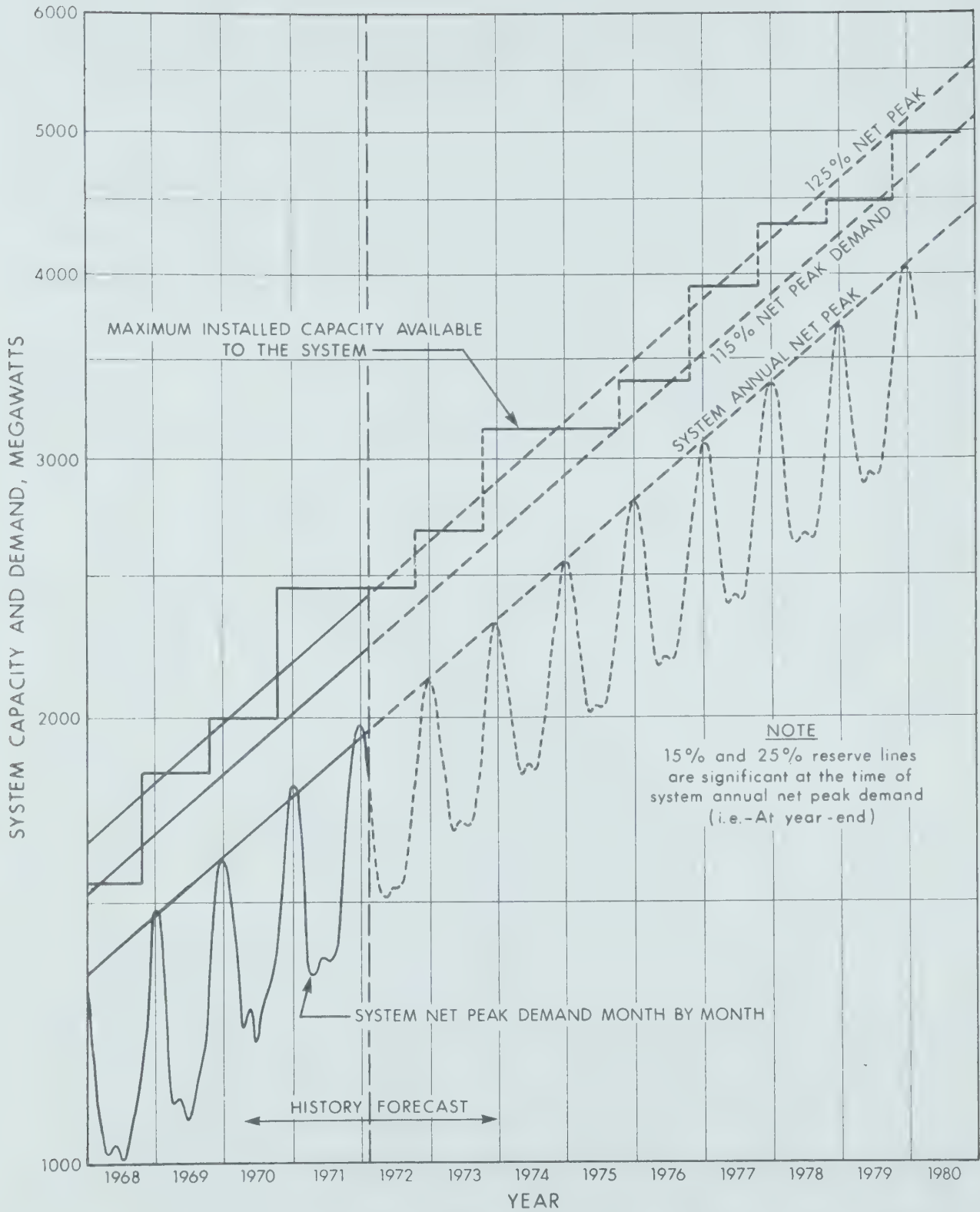
TABLE III-2
FORECAST OF THE NUMBER OF LARGE GENERATING UNITS
ON THE INTERCONNECTED SYSTEM

THE NOMINAL SIZE OF LARGE UNITS (OVER 49 MW)
CLASSIFIED IN SIZE RANGE SHOWN

YEAR	75 MW	150 MW	300 MW	TOTAL OF UNITS OVER 49 MW	
	(50 - 100 MW)	(101 - 250 MW)	(251 - 400 MW)	NUMBER	MW
TOTAL IN 1969	■ ■ ■ ■	■ ■	■	12	1395
INSTALLED 1970	■ ■ ■ ■	■ ■ □	■ □	14	1852
INSTALLED 1971	■ ■ ■ ■	■ ■ ■	■ ■	14	1852
PROPOSED IN 1972	■ ■ ■ ■ □	■ ■ ■	■ ■	17	2085
PROPOSED IN 1973	■ ■ ■ ■ ■	■ ■ ■ □	■ ■	19	2542
PROPOSED IN 1974	■ ■ ■ ■ ■	■ ■ ■ ■	■ ■	19	2542
PROPOSED IN 1975	■ ■ ■ ■ ■ □	■ ■ ■ ■	■ ■	22	2792
PROPOSED IN 1976	■ ■ ■ ■ ■ ■	■ ■ ■ ■ □	■ ■	24	3315
PROPOSED IN 1977	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ □	26	3717
PROPOSED IN 1978	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ ■	27	3888
PROPOSED IN 1979	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ □	■ ■ ■	29	4380

IN 1969 THE SYSTEM ALSO INCLUDED 24 THERMAL UNITS EACH LESS THAN 50 MW AND 10 HYDRO PLANTS WITH A NUMBER OF HYDRO UNITS EACH LESS THAN 50 MW. THE TOTAL CAPABILITY OF ALL THESE SMALL UNITS WAS ABOUT 610 MW OR ABOUT 30% OF THE TOTAL SYSTEM CAPABILITY

BY 1979 THE TOTAL NET CAPABILITY OF ALL THE SMALL UNITS (LESS THAN 50 MW) IS EXPECTED TO GROW SLIGHTLY TO ABOUT 650 MW, BUT THIS WILL THEN REPRESENT ONLY ABOUT 13% OF THE TOTAL SYSTEM CAPABILITY



ALBERTA INTERCONNECTED SYSTEM
ANNUAL DEMAND AND GENERATING CAPABILITY
BASED ON 61% LOAD FACTOR IN 1970 INCREASING TO 65% IN 1980

unit out of service each year from 1977 to 1980 would result in an overall capacity factor for all the other thermal units barely exceeding the 70 per cent with a 286 MW unit out of service during 1975. The Board considers it reasonable to anticipate average operation of the thermal plants of an integrated system at an overall 65 to 70 per cent capacity factor under the assumed outage conditions. This provides some check on the suitability of the size of the units now proposed by Edmonton Power and by Calgary Power in their current applications.

Notwithstanding its respect for the experience and judgment of the respective applicants, the Board, recognizing the capital cost savings which could occur by installing larger units, would have liked to have seen a directly applicable quantitative analysis in support of the size and timing of additional units proposed by Edmonton Power and Calgary Power. In particular, the Board would have been interested in seeing whether a single 500 MW unit, perhaps coupled with a gas turbine unit, might not have served the interconnected system better. For the time being, however, the Board accepts the view of Edmonton Power which agrees with Calgary Power, that the operating experience with 500 MW units is not yet fully satisfactory, and likewise a similar view that would apply to a 300 MW unit in the case of Edmonton Power's own system. Such may not be the case by the time detailed consideration needs to be given to the next stage of expansion. The Board believes that the interconnected system

is in a transition stage and by the late-Seventies the use of larger units will probably be justified.

The Board concludes that the 171 MW units now proposed by Edmonton Power are of suitable size.

IV THE SUITABILITY OF THE CHOICE OF THE ENERGY RESOURCES AND THE ADEQUACY OF THE FUEL RESERVES

Views of the Applicant

The application for the addition of two new units to the Clover Bar plant is based on the continued use of natural gas as fuel, supplied by Northwestern Utilities, Limited. Edmonton Power stated that at the present time economics, air pollution considerations and the plant location preclude the use of any other fuel.

The possibility of using coal as a fuel at the Clover Bar site was investigated by the City of Edmonton in 1965. The results of this study are summarized in a report titled "Future Power Development for the City of Edmonton" which was submitted to the Board after the hearing. This study generally indicated that gas would be the most desirable fuel supply. The study indicated the capital cost of a coal fired installation would be approximately 50 per cent higher than that of a gas fired facility. The lower estimated fuel costs would be insufficient to justify the expenditure of the additional capital. Edmonton Power estimated the fuel cost differential would have to be 10 cents per million Btu before a coal fired plant would be economical.

In addition to the higher costs of a coal fired facility if coal were used, the City would be required to supply a loop railway spur, a conveyor to carry coal into the North Saskatchewan River Valley to the plant site, and a means of disposing of the ash. Additional problems would be encountered due to fly ash

and sulphur dioxide emissions unless sophisticated control equipment were installed.

In 1965, Edmonton Power also studied the possibility of generating power at several locations outside the City. Coal fired plants were considered at the coal fields near Genessee, 50 miles south-west of Edmonton on the North Saskatchewan River, and near Ardley, 100 miles south of Edmonton on the Red Deer River. The possibility of entering into a joint venture for the Ardley project with the City of Calgary and the City of Red Deer was investigated and then abandoned because of differing reports on the coal field and lack of interest in a joint venture on the part of the City of Edmonton. The extra cost of transmission, the much greater capital cost and the high initial cost of coal would result in an energy cost that would be uneconomic for the City. In the 1965 study, Edmonton Power estimated that even if the cost of gas were to rise 10 per cent in 1970, 10 per cent in 1975 and a further 10 per cent in 1980, the economics would still favour the use of gas. These studies concluded that for some time into the future the cost of energy from a coal fired power plant outside the City would not be competitive with the cost of energy from a gas fired power plant located in the City.

Other energy sources, such as hydro and nuclear power generation, were not considered to be reasonable alternatives to the use of gas.

Regarding the adequacy of gas reserves, Edmonton Power stated that, based on the results of a study of the Oil and Gas

Conservation Board⁽¹⁾ and recent discussions with Northwestern Utilities, Limited, it concluded that sufficient gas would be available for four units at the Clover Bar station without supply problems. In the report cited, the Oil and Gas Conservation Board made allowance in its estimate for the use by Edmonton Power of sufficient gas reserves as fuel for the Clover Bar station over its life and also for an additional 1,200,000 KW generating station using natural gas fuel.

Views of the Board

The Board agrees that the use of natural gas in the City has both economic and pollution control advantages at the present time and the Board concurs with the conclusion of the applicant that sufficient gas is available for four units at the Clover Bar station. However, the Board emphasizes that, while it may include within its various reports estimates of gas consumption by a particular user, it assumes that suitable contractual arrangements have been entered into by that user to assure adequate future gas supplies.

While it remains to be seen whether the use of other fuels, or the generation of electric energy elsewhere than in the City, is more acceptable for the next stage of generation after the completion of the four Clover Bar units, the Board agrees with the applicant that natural gas is the most satisfactory fuel to be used for the proposed addition to the Clover Bar plant.

(1) OGCB Report 71-B. Report and Decision Regarding Alberta's Future Requirements for Gas. February, 1971.

V THE SUITABILITY OF PROVIDING THE INCREASED
CAPACITY AT THE CLOVER BAR SITE

Views of the Applicant

As discussed in Section IV, Edmonton Power concluded that gas was the most suitable fuel for the next stage of expansion and this decision then led to the investigation of those sites in close proximity to the load centre of the City. Edmonton Power stated that the Clover Bar site was the most logical choice because of proximity to the City load centre, and proximity to the interconnected Provincial system through the existing high voltage transmission lines of Calgary Power. The generation capacity of Clover Bar units number 1 and 2 exceeds by 90 MVA the peak load requirement of the system in proximity to the Clover Bar plant. This additional 90 MVA will be transferred to the 240 KV bus and added to the generation capacity of units number 3 and 4 for transmission to other parts of the City of Edmonton over Calgary Power high voltage transmission lines.

Edmonton Power stated that the Clover Bar site is also close to a Calgary Power load centre east of Edmonton and could supply 200 MVA of off-peak power to the Calgary Power system. The site is also close to a major gas pipe line system capable of supplying adequate fuel, and is attractive from an environmental point of view since the prevailing winds tend to carry the plume from the power plant away from the City and over an established industrial area. In addition, the site is attractive because the North Saskatchewan River has a volume of flow sufficient to provide

adequate cooling capacity for a plant of the size proposed.

Views of the Interveners

The interveners did not comment on the choice of the Clover Bar site.

Views of the Board

The Board noted the proximity of the power plant to urban, residential and recreational areas, and also the use of the river for cooling water, and deals with these aspects of the matter in Section VIII of this report.

The Board agrees that, with the general capital cost stated by the applicant for gas fired thermal generation and the availability of natural gas and cooling water at the Clover Bar site and strictly from the viewpoint of economical generation of electric energy in proximity to the City of Edmonton, the site is one of the preferred locations in the Edmonton area. The Board also agrees with Edmonton Power that the completion of the Clover Bar site to its ultimate capacity before starting a new thermal site appears sound on the basis of the data presented.

Considering the whole interconnected system of the Province, the Board notes that there are major load centres in the Edmonton area both within the City of Edmonton and within the area presently served by Calgary Power Ltd. The addition of generation capacity in proximity to these load centres appears prudent. The Board accepts that the transmission and transmission interconnection planned in connection with the proposed addition to the Clover Bar plant are appropriate. However, further system

studies and data on transmission capacity and loading, including the effects of operating gas fired thermal plants at other than base load, other generation in the Province and likely contingencies in the period 1975 to 1980, will be required by the Board in the next year or two, as is further discussed in Section IX.

The Board concludes that the proposed location for the provision of increased capacity is satisfactory subject to the adequacy of environmental protection.

VI THE ENERGY CONVERSION EFFICIENCY

Views of the Applicant

Edmonton Power presented typical design data for the proposed units numbers 3 and 4 as follows:

Edmonton Power Clover Bar 330 MW Extension

Typical Energy Balance of the combined Units 3 and 4 at Maximum Continuous Rating

	<u>Heat Load</u> <u>10⁶ Btu/Hour</u>	<u>Per Cent</u>
1. Natural Gas 2,870 MCFH @ 1,086 Btu/SCF	3116	100.0
2. Steam Generator Losses	480	15.4
3. Net Heat to Turbine	2636	84.6
4. Auxiliaries' Consumption (16 MW)	54	1.7
5. Net electrical output	1070	34.4
6. Heat rejection to cooling water via condensers	1512	48.5
7. Cooling water flow 7.8 x 10 ⁷ lbs/hr @ 19.4 degrees Fahrenheit rise	1512	48.5

The proposed units would be single reheat, compound condensing turbines with high, medium, and low pressure cylinders. Inlet steam would be supplied to the turbine at a pressure of 1800 psi and a temperature of 1000⁰ Fahrenheit, and the reheat temperature would be 1000⁰ Fahrenheit. A regenerative type air preheater would cool the flue gas from 630⁰ F to 250 - 285⁰ F depending upon plant loading.

Edmonton Power also presented a comparison of typical design figures for a 165 MW unit and a 300 MW unit. These figures showed an improvement in energy conversion for the 300 MW unit over the

165 MW unit of only a little over 1 per cent. Edmonton Power stated that, in general, the expected improvement in efficiency by installing a 300 MW unit instead of a 165 MW unit is a maximum of 5 per cent. Edmonton Power also presented data of predicted loads, heat rates, and gas consumption for the period 1971 to 1980. These figures for the combined operation of both the Clover Bar and Rosssdale power plants show a gradually improving heat rate with a high of 11,164 Btu per kilowatt-hour in 1972 to a low of 10,186 Btu per kilowatt-hour in 1979.

Views of the Interveners

The City of Calgary expressed the opinion that the 165 megawatt unit size was related primarily to the growth of the City of Edmonton, and that City of Calgary studies have demonstrated increased costs to be expected from small size units. The City of Calgary did not single out thermal efficiency as particularly significant. Canadian Utilities and Calgary Power did not comment on the efficiency of the proposed units.

Views of the Board

The efficiency of the proposed Clover Bar units affects the overall efficiency of the interconnected system and is thereby related to the efficiency of the units proposed for the Sundance site. For completeness and continuity, parts of the discussion with respect to the Sundance site have been repeated in what follows in connection with Clover Bar.

The Board notes that the overall design efficiency of the

generation of electric energy from fuel with the proposed units will be slightly better than 34 per cent. This corresponds to a thermal conversion of about 9900 Btu per kilowatt-hour and is similar to that of the existing 165 Megawatt unit. The largest, most efficient power plants show thermal conversion design figures of about 8700 Btu per kilowatt-hour; but actual thermal conversion figures recorded with these plants in operation are between 9000 and 10,000 Btu per kilowatt-hour. The failure to attain design figures can be attributed to the effect of these units operating at loads different from their design ratings, to the use of fuels differing from those for which the boilers were designed, and to the addition of environmental protection devices.

In the past 50 years thermal conversion has improved from about 25,000 Btu per kilowatt-hour to just under 9,000 Btu per kilowatt-hour. However, it has taken the last ten years to improve thermal conversion from 10,000 to 9,000 Btu per kilowatt-hour, and present expectations are that many years of research will be required before conventional fossil fuel units can be expected to approach the theoretical limit of approximately 7,000 Btu per kilowatt-hour.

The Board concludes that units with reheat, operating at 1000^o Fahrenheit and in the range of 1800 to 3000 psi, are the norm for the size of units proposed, and that the energy conversion efficiency of the proposed Clover Bar units is satisfactory having regard to present technology, reliability and the fuel.

VII THE RELATIONSHIP OF THE PROPOSED ADDITION
TO THE EXISTING POWER PLANT

Views of the Applicant

The application of Edmonton Power is, in part, for approval of an addition to the existing power plant. Edmonton Power submitted that the two units proposed were logical additions to the power plant and would allow the installation of an identical pair of units similar to the first two units installed at the Clover Bar site.

Information was furnished on the existing operation including a description of matters affecting the environment. Appendix A provides a description of approvals obtained from other Government agencies. In particular, a research project involving wind tunnel study and concerned with the dispersal of Clover Bar smoke plumes has resulted in a decision by Edmonton Power that the proposed stack height of about 230 feet above grade level is adequate. The applicant referred to other advantages of the common facilities already at the site and attached an estimated value of \$1,300,000 to these advantages.

Views of the Interveners

The City of Calgary, Calgary Power and Alberta Power as interveners agreed that the addition to the capability of the Edmonton system was required, but did not comment specifically on the relationship of the proposed addition to the existing power plant.

Views of the Board

In view of the close relationship between the subject of the application, the proposed addition of units number 3 and 4, and the existing Clover Bar Power Plant, the Board believes it proper to consider a single approval covering both the existing plant and the proposed addition. This would be compatible with the provisions of The Hydro and Electric Energy Act, and would allow the incorporation of conditions suitable for ensuring that the entire operation at the Clover Bar site conform with the appropriate standards related to environmental control. Such treatment would be the same as that applied in the case of the 1971 Battle River application and the recent Sundance application.

VIII THE IMPACT OF THE PROPOSAL ON THE ENVIRONMENT

Atmosphere

The principal effects of the operation of the first two units of the Clover Bar power plant and the additional two proposed units on the atmosphere would be those associated with the discharge of oxides of nitrogen, derived from the combustion of the gas fuel.

(1) Relevant Provincial Standards

The standards of the Department of the Environment relate both to the emission of the pollutants and to the actual ground-level concentrations.

With respect to the permissible emissions of gaseous pollutants, the Department expresses the maximum permissible quantities in terms of the calculated ground level concentration resulting from the discharge of the expected pollutants through a stack of prescribed height. The standard requires that the calculated ground level half-hour average concentration of oxides of nitrogen expressed as nitrogen dioxide not exceed 0.30 parts per million in rural areas and 0.20 parts per million in urban areas.

The ground level concentration standards of the Department are expressed in the publication "Ambient Air Quality Standards" issued by the Environmental Health Division of the Department of Health in September, 1970. These limit actual ground level concentrations of total oxides of nitrogen, expressed as nitrogen dioxide, to 0.30 parts per million averaged over one hour and to 0.10 parts per million averaged over 24 hours.

(2) Views of the Applicant

The applicant stated that the waste gases from Units 3 and 4 would be exhausted to the atmosphere through a single stack 16 feet in diameter serving both boilers. The stack would be identical to that presently used for Units 1 and 2 and would be 231 feet above grade in height.

Edmonton Power stated that at maximum continuous rating the average oxides of nitrogen emission rate per unit would be 480 pounds per hour and the maximum rate would be 570 pounds per hour. These rates are equivalent to 1.6 and 1.9 standard cubic feet per second and stack gas concentrations of 300 and 350 parts per million at the average and maximum emission rates respectively. Using the above emission rates and stack gas concentrations the applicant calculated a maximum ground level concentration of oxides of nitrogen expressed as nitrogen dioxide from the four units of 0.148 parts per million at ground level, well within the Provincial standard of 0.20 parts per million. The applicant stated that tests made on the existing unit at maximum continuous rating indicated the actual stack concentration of oxides of nitrogen to be 210 parts per million, much less than that predicted. This lower concentration would result in lower ground level concentrations of oxides of nitrogen than indicated by the calculations and quoted above.

In order to ensure that emissions would be a minimum the applicant proposes to incorporate overfire ports for reduction of oxides of nitrogen on all boilers. Consideration is also being given to modifying the boilers for flue gas recirculation to

further reduce oxides of nitrogen emissions. The proposed modifications result from a research test program which commenced at the plant in 1970 on reducing the formation of oxides of nitrogen in the combustion chamber of the boilers.

To assist in the control of emissions of oxides of nitrogen during day to day operations the applicant proposes to equip both stacks with continuous mass emission rate monitors to continuously measure and record the emission of oxides of nitrogen to the atmosphere.

To determine the effect of ground topography and building obstruction on the **behaviour** of the plumes from the Clover Bar Generation Station the applicant engaged a consultant to conduct a wind tunnel study. The study indicated that the proposed 231-foot stack height is sufficient to remove the plume from the region of pronounced aerodynamic downwash in the vicinity of the plant at the wind speeds tested, from 13 to 27 miles per hour.

The applicant has carried out a program of atmospheric monitoring for several months of each winter since 1967. Atmospheric oxides of nitrogen and ozone concentrations were measured continuously at four different locations in the north-east section of the City of Edmonton. The applicant stated that the test results show that the Clover Bar Unit No. 1 has not increased oxides of nitrogen levels at the locations studied by any measurable amount to date. The applicant proposed to continue the test program and to expand it further to obtain summer data.

Edmonton Power was questioned regarding what plant

modifications might be required in the future to allow for recreational use or possible residential development close to the plant. In reply it stated that in the event that recreational or residential development resulted in a change of the present environmental standards it would be prepared to make whatever plant modifications might be necessary to comply with the change.

(c) Views of the Board

Board staff calculations of the nitrogen oxides emission rates at full load conditions indicate that the equivalent maximum nitrogen dioxide emission rate would be 560 pounds per hour per unit. Using this emission rate Board staff calculated a maximum one half hour average ground level concentration of nitrogen dioxide of 0.20 parts per million with four units operating at maximum continuous rating. This concentration is higher than that calculated by the applicant but still meets the Provincial standard.

Considering the results of the Board staff calculations, the applicant's calculations, the test results indicating lower than design emission rates of oxides of nitrogen and the wind tunnel test results submitted by the applicant, the Board is of the opinion that the measures proposed by the applicant for protection of the atmospheric environment are satisfactory. Should an approval be issued for the plant, the Board believes that it would be appropriate to express the pollutant emission restrictions directly in terms of the maximum number of tons per day of each pollutant rather than indirectly through calculated ground level

concentrations. Further, the Board had adopted restrictions on actual ground level concentrations of oxides of nitrogen equivalent to the Department's calculated concentrations and more stringent than the Provincial Ambient Air Quality Standards. The Board believes it proper that any approval issued for the plant contain conditions requiring that actual ground level concentrations of oxides of nitrogen not exceed the stricter of these two standards.

Water

Several features of the present and proposed operation of the Clover Bar plant affect or could affect the North Saskatchewan River. Most important is the possible effect on the fish and plant life of the river of the temperature increase caused by the addition of heat to the plant cooling water. Other matters of concern are the disposal of auxiliary cooling water, the disposal of boiler blowdown, the disposal of demineralizer wastes and the containment of oil and chemical spills.

(a) Relevant Provincial Standards

The standards prescribed for the Province are those set forth in the publication "Surface Water Quality Criteria" issued by the Environmental Health Division, Alberta Department of Health, August, 1970. The prime considerations respecting this application are the temperature rise resulting from circulation of cooling water, the pH of the water returned to the river and possible oil and chemical spills.

The standards state that the temperature rise above the

ambient water temperature shall not exceed 3 Centigrade degrees (5.4 Fahrenheit degrees). With respect to pH the standards require this to be in the range of 6.5 to 9.5 but not altered more than 0.5 pH units from background value. The standards require that oils and greases be substantially absent. In commenting on the specific water quality objectives the publication states that the standards are for evaluation of conditions except in close proximity to outfalls as prescribed by the Provincial Board of Health (whose functions in this area are now being carried out by the Division of Standards and Approvals of the Department of the Environment).

(b) Views of the Applicant

The applicant stated that with all four units operating at maximum continuous rating the heat rejection to the cooling water would be approximately 50 million Btu per minute. This would result in a cooling water temperature increase of 19.4 Fahrenheit degrees. At minimum river flow rates of 1,125,000 gallons per minute the river temperature would increase approximately 4.5 Fahrenheit degrees after complete mixing, which temperature increase falls within the Provincial standard of 5.4 Fahrenheit degrees. The applicant stated that once the Bighorn Project becomes operational the minimum river flows would be somewhat higher and less temperature rise would result. During summer flow conditions the temperature rise after complete mixing with 4 units operating at maximum continuous rating was calculated to be approximately 2.2 Fahrenheit degrees.

Preliminary observations indicate that the heated cooling

water discharged from the plant mixes gradually with the general river flow and stretches out into a long warm zone which stays quite close to the bank of the river. After flowing some distance downstream the temperature of this heated zone approaches the upstream ambient river water temperature. The preliminary observations indicate that no thermal barrier to the migration of aquatic life would be formed. Edmonton Power proposes to further study the effects of the generating station thermal discharge on the North Saskatchewan River to ensure that no harm would result.

Auxiliary cooling water would be discharged directly into the main cooling water discharge lines which discharge to the river approximately 300 feet downstream from the pumphouse. Because of the relatively low heat rejection the river temperature increase due to the auxiliary cooling water heat load would be negligible.

The applicant stated that boiler blowdown would be cooled before discharge to the river. Maximum blowdown rate per unit would be 15,000 gallons per day, although the normal blowdown for Unit 1 now averages less than 150 gallons per day. The pH of this water is normally between 9.5 and 9.8.

Demineralizer wastes would be collected in a tank and neutralized to a pH of 6.0 to 8.0 before discharge to the river. Edmonton Power stated that the completed station with four units operating would create less than 20,000 gallons per week. The discharge of these wastes to the river was approved for four units by the Department of the Environment with the issuance of

Final Water Pollution Approval No. 171-S-1971 dated September 24, 1971.

The applicant stated that plant oil spills would be contained by an oil separator installed in the plant drains sump. Major plant chemical spills would be contained within dikes surrounding the bulk acid and caustic storage tanks. A holding pond would be used for containment of waste water resulting from boiler cleaning.

(c) Views of the Board

The Board recognizes that excessive heat rejected from the cooling process to the river could cause environmental problems, especially if a region of heated water were to extend across the entire river channel. However, preliminary studies undertaken by the applicant indicate that the expected temperature rise in the river will not exceed the present thermal standards of the Department. The applicant further states that an improved situation in the river due to increased flow should exist in the future after the Big Horn Dam becomes operative, and the Board appreciates that variable flows in the river will result in variable temperature changes. As a condition of approval therefore, the Board believes that the applicant should arrange for properly qualified persons to conduct temperature and biota studies of the river as required by the Department of the Environment to ensure that proper water quality is maintained.

With respect to the auxilliary cooling water the Board notes that it will be discharged into the main cooling water lines

and because of low heat content in comparison with the condenser cooling water will have a negligible effect on river temperature.

As a condition of approval, the disposal of boiler blowdown water, demineralizer wastes, boiler cleaning solutions and other chemical processes should meet the proper water quality standards and disposal methods as required by the Department of the Environment.

IX THE ADEQUACY OF THE PRESENT PLANNING
FOR THE EXPANSION OF ELECTRIC GENERATION
AND TRANSMISSION FACILITIES IN ALBERTA

Views of the Applicant

Edmonton Power stated that a suitable level of generating reserve capacity had been accomplished by the joint planning committee. The applicant also stated that liaison between the three parties to the Reserve Sharing Agreement occurred either in formal meetings held in an office, or in other ways for a total of about one-half dozen times per year.

Views of the Interveners

(1) Alberta Power

Alberta Power stated that it had reviewed the Edmonton Power application and considered the proposed additions to the power plant to comply with the intent of the Reserve Sharing Agreement and to be in the public interest.

(2) City of Calgary

The City of Calgary stated that, "As the largest non-generating electrical utility in the Province, the City of Calgary proposes to initiate and to participate fully in the investigation of the practicability of a joint venture for the generation of electric energy in Alberta. We urge the Board to endorse the concept of such a joint venture so that planning may commence immediately as it must if such an undertaking is to be ready to meet the electric demands of the Province by 1978".

The City of Calgary said it based its statement on the fact

that given the power plants, for approval of which Edmonton Power and Calgary Power were applying, the generation requirements of the interconnected system would be met up to the year 1978, but then the major generating utilities in Alberta must have under construction the plant or plants to handle the next phase of load growth of the Province. The City of Calgary submitted that the Board should favour the formation of a joint venture of those electrical utilities willing to share in the costs and benefits of a generating plant located on the most economic site with units suited to the overall requirements of the Provincial grid.

The City of Calgary further clarified its submission by stating that it was asking the Board to investigate the practicability of such a venture. It stated that it was willing to become a partner if such a scheme was practical and that it had the authority to participate in a joint venture in the development of a public utility under the terms of section 273 of The Municipal Government Act. The City of Calgary did not make any comment on the adequacy of present planning. However, it urged the Board to endorse the concept of joint venturing so that planning could start immediately in order to meet the electrical demands of the Province by 1978.

Views of the Board

The views of the Board on the subject of joint planning are fully expressed in the Calgary Power report on the expansion of the Sundance plant. Because the question of planning is of such vital importance to the Province as a whole the Board considers

it advisable to repeat its views in this report.

Notwithstanding the discussion, and exchange of information described by Edmonton Power as having taken place with Calgary Power and Alberta Power during the planning process the Board believes that overall planning in the future could be improved in the public interest. The evidence heard at the hearings of the applications of Edmonton Power, Calgary Power and Canadian Utilities indicates that the current type of planning is primarily related to co-operation between the three essentially separate systems. Each of the three utilities appears to keep the others informed of the size and location of proposed units to be installed in its own system, but there seems to be no direct appraisal of the need, size, type and location of units from an overall Province-wide basis.

Moreover, as indicated to the Board in the Calgary Power hearing, planning has been directed principally to the provision of needed capacity with little direct consideration to the suitability of the resulting energy reserves. The Board also believes that adequate planning should incorporate a study of the scheduling of the operations of the units in the interconnected system for overall optimum operations. Environmental problems have become a major concern and their consideration must be included in future planning. Further, it would appear that insufficient consideration has been given to the possible advantages of joint venturing.

The Board finds that the objectives outlined in the preamble

of the Reserve Sharing Agreement are generally compatible with good planning. However, section 11 of the Agreement appears to override some of these objectives by permitting each utility to consider, and to encourage it to develop, its own requirements more or less in isolation rather than in the best interest of the Province as a whole.

The Board suggests that the Reserve Sharing Agreement involving only the three major generating utilities does not fully satisfy the desirable criteria for a planning program for the future. Both the Cities of Medicine Hat and Lethbridge are involved in electric energy generation and had expressed a desire either at the hearing or subsequently to participate in overall planning and to be kept informed of the joint operation procedures. The City of Calgary also wishes to participate in any future planning program and would also be prepared to join financially in future development if practical.

As Calgary Power had already stated to the Board at its hearing, however, no serious power failure or shortage of power or energy has been experienced under the present co-operative action. The Board is impressed with this record based on voluntary and informal planning and joint operation and it speaks well of the combined efforts of the major generating utilities at this date. While present planning methods have served the Province well to this time the Board believes that more comprehensive and formal planning must be carried out in the future.

The Board urges the establishment of a more formal Inter-Utility-Planning Committee to carry out future planning studies. The membership of this planning committee should include not only the present parties to the Reserve Sharing Agreement but also representatives from the City of Calgary, the Cities of Red Deer, Medicine Hat and Lethbridge, as well as a representative from the Co-operative Activities and Credit Unions Branch of the Department of Agriculture. The Board would be prepared to have an observer attend appropriate committee meetings.

The Board requests that a suitable committee be established as soon as possible and that it proceed immediately with studies of future generation and transmission programs to provide for optimum development to serve the interconnected system of Alberta in the public interest for a period of twenty or so years. Such studies should cover the possibility of developing any part of the future facilities by means of joint ventures. The Board also asks that a report outlining the results of the studies be presented to it at the earliest practical time.

X DECISION

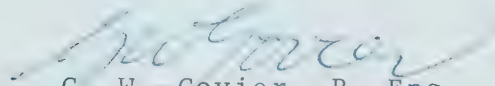
Having regard to its responsibilities under the Act and to its views herein expressed, the Board is prepared, with the approval of the Lieutenant Governor in Council, to issue to Edmonton Power an approval pursuant to section 7 of the Act. The approval would be of the construction of Units 3 and 4 and of the operation of the expanded power plant. In effect it would be a consolidation of the approval the applicant is now deemed to hold for Units 1 and 2 with one for the construction and operation of the proposed additional Units 3 and 4. The conditions contained in the approval would apply to the entire operation.

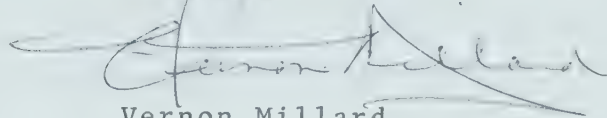
Having concluded that the additional generating capacity is needed and that the proposed additional Units 3 and 4 are suitable for the service of consumers supplied by Edmonton Power and for the generation of electric energy in Alberta, the Board is prepared, with the approval of the Lieutenant Governor in Council, to order the connection of Units 2, 3 and 4, when they are constructed, to the Edmonton Power transmission lines and the Calgary Power transmission lines at the Clover Bar site.

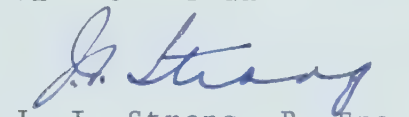
The approval and order would be generally in the forms


set out in Appendix B, and subject to the terms and conditions herein contained.

Respectfully submitted,


G. W. Govier, P. Eng.
Chairman


Vernon Millard
Vice Chairman


J. I. Strong, P. Eng.
Board Member


N. Berkowitz
Board Member

DATED at Calgary, Alberta

this 25th day of April, A.D. 1972.

APPENDIX A

SUBSISTING APPROVALS FOR THE CLOVER BAR

POWER PLANT

Edmonton Power from time to time obtained certain approvals, permits and licences for the Clover Bar power plant. The approvals, permits and licences granted by Provincial authorities are:

1. September 14, 1967 - Interim Licence No. 6047, from the Director of Water Resources, for construction of works necessary for utilization of water applied for from North Saskatchewan River for industrial purposes.
2. April 18, 1968 - Final Air Pollution Approval No. 689-EDM-P-084, from Provincial Board of Health, for power plant of two units each having a capacity of 165 megawatts.
3. June 8, 1971 - Final Water Pollution Approval No. 165-S-1971, from Provincial Board of Health, for chlorination of cooling water at the Clover Bar Generating Station.
4. September 24, 1971 - Final Water Pollution Approval No. 171-S-1971, from Provincial Board of Health, for water pollution control at the Clover Bar Generating Station.

In addition the following were granted by local authorities:

5. January 5, 1968 - From the Edmonton Regional Planning Commission, approval of the location of the plant and confirmation that a certain subdivision approval of April 1967 had that effect.
6. January 19, 1968 - From the City Planning Department, City of Edmonton, Development Permit to construct a power plant.

APPENDIX B

FORMS OF APPROVAL AND ORDER

Form of Approval

PROVINCE OF ALBERTA
THE HYDRO AND ELECTRIC ENERGY ACT
ENERGY RESOURCES CONSERVATION BOARD

IN THE MATTER of the Clover Bar
power plant of the City of
Edmonton, above the east bank
of the North Saskatchewan River
in the City of Edmonton

APPROVAL NO. HE

The Energy Resources Conservation Board, pursuant to
The Hydro and Electric Energy Act, being chapter 49 of the
Statutes of Alberta, 1971, and the Lieutenant Governor in
Council having given his authorization by Order in Council
dated _____ 1972, and numbered O.C. _____/72,
hereby orders as follows:

1. The construction and operation by the City of
Edmonton (hereinafter called "the Operator") of a power plant
located in the S.W.¼ of Section 20, Township 53, Range 23,
West of the 4th Meridian, above the east bank of the North
Saskatchewan River in the City of Edmonton is approved.

2. Subject to the other provisions of this Approval,
the power plant shall be in accordance with

(a) Interim License No. 6047 dated September 14,
1967, from the Director of Water Resources

- for the utilization of water applied for from the North Saskatchewan River,
- (b) Approval No. 689-EDM-P-084, dated April 18, 1968, from the Provincial Board of Health, granting a Final Air Pollution Approval subject to certain conditions for the installation and operation of Unit No. 1 and Unit No. 2.
 - (c) Approval No. 165-S-1971 dated June 8th, 1971, from the Provincial Board of Health granting a Final Water Pollution Approval for the chlorination of cooling water at the Clover Bar Generating Station,
 - (d) Approval No. 171-S-1971 dated September 24th, 1971, from the Provincial Board of Health granting a Final Water Pollution Approval for water pollution control at the Clover Bar Generating Station, and
 - (e) an application by The City of Edmonton on behalf of Edmonton Power to the Energy Resources Conservation Board dated September 24th, 1971 and evidence given in support of the application at a hearing on January 13th, 1972.

3. (1) The waste gas from the power plant boilers shall be emitted to the atmosphere through two stacks of a height

(a) of not less than 231 feet, and

(b) sufficient to maintain the half-hour average ground level concentration of oxides of nitrogen, expressed as nitrogen dioxide, below 0.20 parts per million.

(2) The emission of oxides of nitrogen, expressed as nitrogen dioxide, to the atmosphere from each boiler stack shall not exceed 12 long tons per day.

(3) The waste heat from the condenser cooling water when returned to the North Saskatchewan River shall not result in a thermal barrier, as defined by the Department of the Environment, exceeding 5.4 Fahrenheit degrees.

(4) The disposal to the North Saskatchewan River of any water from the auxiliary cooling, boiler blowdown, chemical processes, or other power plant use shall be in a manner satisfactory to the Department of the Environment and shall meet or be better than any applicable standard of water quality or purity as determined by the Department of the Environment.

4. (1) The Operator shall conduct temperature and biological surveys of that portion of the North Saskatchewan River which might be affected by the operation of the power plant as required by the Department of the Environment.

(2) The Operator shall maintain a monitoring program satisfactory to the Department of the Environment to provide a continuous record of the ground level concentrations total oxides of nitrogen in the atmosphere, wind speed and wind direction.

(3) The Operator shall continuously monitor to the satisfaction of the Board the mass emission rate of total oxides of nitrogen from each stack.

(4) The Operator shall promptly report

(a) to the Department of the Environment,
data from the surveys and programs
required under subclauses (1) and (2),
and

(b) to the Board, data from the monitoring
required under subclause (3).

5. The Board at any time,

(a) upon its own motion, or the request of
the Department of the Environment, or

(b) upon the application of an interested person,
may vary the terms and conditions hereof or rescind this
approval.

MADE at the City of Calgary, in the Province of
Alberta, this _____ day of _____, A. D. 1972.

ENERGY RESOURCES CONSERVATION BOARD

G. W. Govier
Chairman

Form of Order

THE PROVINCE OF ALBERTA
THE HYDRO AND ELECTRIC ENERGY ACT
ENERGY RESOURCES CONSERVATION BOARD

ORDER NO. Misc HE

An order regarding the Clover Bar Power Plant

The Energy Resources Conservation Board, pursuant to The Hydro and Electric Energy Act, being chapter 49 of the Statutes of Alberta, 1971, and the Lieutenant Governor in Council having given his authorization by Order in Council dated _____, 1972, and numbered O.C. _____/72, hereby orders as follows:

1. The City of Edmonton at the time of the commencement of the operation of each of Unit 2, Unit 3 and Unit 4 of the Clover Bar Power Plant shall connect that unit to its transmission lines at a point in the South-west quarter of Section 20, Township 53, Range 23, West of the 4th Meridian.

2. The City of Edmonton at the time of the commencement of the operation of each of Unit 2, Unit 3 and Unit 4 of the Clover Bar Power Plant shall connect that unit to the transmission lines of Calgary Power Ltd. at a point in the South-west quarter of Section 20, Township 53, Range 23, West of the 4th Meridian.

MADE at the City of Calgary, in the Province of Alberta,
this day of , A. D. 1972.

ENERGY RESOURCES CONSERVATION BOARD

G. W. Govier
Chairman

